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¹ BGBI: Bundesgesetzblatt (Federal Law Gazette)

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Frankfurt/Main, Theodor-Stern-Kai 1

41/129

Arrangement For Limiting Overspeeds In Turbo-
Generator sets

The present invention relates to an arrangement for limiting overspeeds in turbo-generator sets.

Turbo-generator sets are usually operated in an interconnected operation. The speed corresponds to the line frequency and can hardly be changed by changes in the load. However it is absolutely necessary to control the speed in case of a load-shedding or during the phases of start-up and shutdown.

The maximum speed change permissible in compensation processes is limited by the trip speed that normally amounts to 1.1 times the rated speed. Apart from the load by the generator, there are no other alternatives to exert negative torques on the turbo-rotors. Therefore, attempts are made with the aim of maintaining the operating power that enters into the turbine after the occurrence of a load-shedding to the lowest level possible. The problem encountered when controlling the speed is to ensure a stable operation on the one hand while on the other hand maintaining the

overspeeds occurring during a sudden load-shedding to the lowest level possible or at least lower than the trip speed. Devices known for this purpose range from those that are chiefly used for the normal speed control loop to continuously acting devices that operate by recording either the speed change or the output change and emitting a signal for closing the steam valves once certain limit values are exceeded. This problem is solved by the arrangement for limiting overspeeds in turbo-generator sets according to the present invention by providing a speed controller that consists of a proportionally acting control branch and a control branch parallel to the former control branch and containing a device for the delayed differentiation and a characteristic line member arranged downstream having a greater amplification in case of high negative input values.

The present invention is explained in the following description on the basis of the embodiment illustrated in the figure where additional characteristics are also described.

The difference between the target value n_s and the actual value n_i of the speed is formed in the summation locations 1 and 2. According to the illustrated frequency response, the block 3 transmits the difference in the target value and the actual value of the speed based on a reference frequency f_{oi} that corresponds to the speed target value in the example illustrated. The difference between the target value and the actual value is evaluated using a factor K_9 that should be independent of the

stabilization issues of the speed control loop and should have the value 1 here. The block 3 preferably operates digitally since it is required to be accurate, though not very fast. In this case, the block can be designed as comprising a counter having a delay element arranged downstream. In an output control that is superimposed by the speed control, the output value of the block 3 in the interconnected operation corresponds to an output target value, the so-called frequency share. In case of an exclusive speed control, the output value of the block 3 corresponds to the output value of a proportionately acting speed controller.

The amplification required for stabilizing the speed control loop is determined by the blocks 4 and 5. There is no transmission from block 4 for the remaining differences between the target value and the actual value corresponding to the nature of the frequency response illustrated. Signal changes having a frequency lying above the break frequency of block 4 are normally transmitted corresponding to the slightly inclined characteristic curve of the block 5. If the signal given by block 4 assumes high negative values as does happen when the speed increases rapidly as a result of a sudden load-shedding, then the amplification is raised corresponding to the strongly inclined characteristic curve in the third quadrant of the characteristic curve family of the block 5. The contribution delivered by block 3 is thus

reduced faster, i.e. the output signal of the speed controller changes faster towards "Close steam valve."

The control branch consisting of the blocks 4 and 5 operates in an analog mode since higher demands are made on its speed than its accuracy. The block 4 can be described as a device that converts signals by delayed differentiation and whose design can be considered to be sufficiently known. The block 5 consists of an operational amplifier having a corresponding circuitry.

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41/129

Claims

1. Arrangement for limiting overspeeds in turbo-generator sets, characterized in that the speed controller consists of a proportionally acting control branch and a control branch parallel to the former control branch and containing a device for delayed differentiation and a characteristic curve element arranged downstream having a greater amplification at high negative input values.
2. Arrangement pursuant to claim 1, characterized in that the output control is superimposed by a speed control.
3. Arrangement pursuant to claim 1 or 2, characterized in that the proportionally acting control branch operates digitally.
4. Arrangement pursuant to claim 3, characterized in that the proportionally acting control branch consists of a counter having a delay element that is arranged downstream.
5. Arrangement pursuant to any of the claims 1 to 4, characterized in that the characteristic curve element consists of an operational amplifier having a corresponding circuitry.

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-7-

